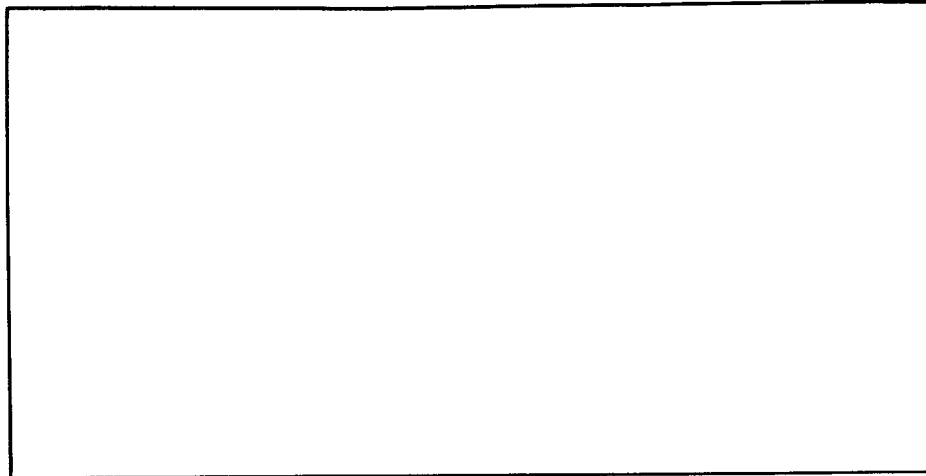


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(E72-10359) DETERMINATION OF AEROSOL  
CONTENT IN THE ATMOSPHERE FROM ERTS-1  
DATA Progress Report, 7 Nov. 1972 - 6  
C.B. Ludwig, et al (Science Applications,  
Inc.) 7 Jan. 1973 12 p

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DETERMINATION OF AEROSOL CONTENT  
IN THE ATMOSPHERE FROM  
ERTS-1 DATA

Progress Report No. 2

Contract No.: NAS5-21860

Period Covered: 7 November 1972 to 6 January 1973

Proposal Number: 245

GSFC ID Number: P135

Principal Investigator: Dr. C. B. Ludwig

Author: Dr. M. Griggs

Prepared for:

Goddard Space Flight Center

7 January 1973

## ACCOMPLISHMENTS

During the second two-month period of this contract, the preliminary data analysis was continued, and ground-truth measurements were made at both test sites.

### GROUND-TRUTH MEASUREMENTS

The NASA aircraft flight scheduled for December 12, 1972, at the Salton Sea was postponed due to failure of the MSS on the aircraft. The flight is now scheduled for February 4, 1973.

Ground-based observations of the aerosol optical thickness at the Salton Sea were made on December 12, 1972, coincident with the ERTS-1 overpass. Measurements were made with the Volz photometer and the Exotech radiometer. The results obtained with the Volz photometer are shown in Figure 1, together with results obtained in San Diego at the times of three ERTS-1 overpasses. It is seen that the aerosol thickness is less than the Elterman 1964 model value for each overpass. Unfortunately the ERTS-1 data for these overpasses have not been received yet.

The Exotech radiometer did not function correctly so that data were not obtained with it. Preliminary examination of the instrument did not resolve the problem, and further tests are necessary.

### PRELIMINARY DATA ANALYSIS

#### Software Development

New sample data have been received, and a program has been developed to read the tapes on a CDC 6400. Initial tests indicate that the tapes can be handled satisfactorily.

## Theoretical Analysis

The relationship

$$f(\tau) = A' (C_o/C_R - 1)$$

where

$$f(\tau) = \frac{R(\tau, 0)}{R(\tau, 1) - R(\tau, 0)}$$

previously discussed for a wavelength of  $0.7\mu$  has been calculated for the center wavelengths of the four MSS channels, based on interpolation of values of  $R(\tau, 0)$  and  $R(\tau, 1)$  calculated by Plass and Kattawar, Appl. Opt. 7, 1129 (1968); 9, 1122 (1970); 11, 1598 (1972), for the wavelengths  $0.4\mu$ ,  $0.7\mu$ ,  $0.9\mu$  and  $1.67\mu$ . The results, for three sun angles, are shown in Figures 2, 3, 4 and 5.

## Preliminary Data Examination

The grey scale irradiance calibration data has been obtained from G. E. personnel, and the ERTS-1 data received to date have been analyzed.

The only data received so far are two complete sets and one partial set for the Salton Sea. These data were analyzed with a densitometer and the transparency densities were converted to radiances. The radiance of the water across the Salton Sea was found to be almost constant on a given frame, but, as expected the desert surface was quite variable in radiance. The apparent contrast,  $C_R$ , was computed using the brightest portion of the adjacent desert.

The variation of  $C_R$  with wavelength for the three sets of data is shown in Figure 6. The results show some deviation from the expected

increase of  $C_R$  with wavelength. These deviations are tentatively attributed to the lack of a reliable in-flight radiance calibration.

The values of  $C_R$  were used to make a preliminary estimate of aerosol content using Figures 2, 3, 4 and 5. The inherent contrast  $C_0$  was calculated by assuming a reflectivity of .30 for the desert and .02 for the Salton Sea (based on albedos measured by Griggs. J. Appl. Meteor. 7, 1012 (1968)), giving a value of 12.5 for  $C_0$ . For this preliminary examination, the same value was assumed for all sets of data, neglecting the variation with wavelength and sun angle.

The calculated values of the aerosol content in terms of N (Elterman's 1964 aerosol content) are shown in Table I. The results are not unreasonable in terms of possible aerosol content (compare with Figure 1), although no ground-truth data are available for comparison.

TABLE I

MSS Channel	Aerosol Content			
	4	5	6	7
8-26-72	2.5N	1.7N		
10-1-72	.9N	.8N	1.0N	2.5N
11-6-72	1.8N	.07N	1.1N	.7N

As expected from the plot of  $C_R$  in Figure 6, there are inconsistencies for a given overpass. The data for 10-1-72 look very good if Channel 7 is ignored.

### Future Plans

In the next reporting period it is planned to further analyze the ERTS-1 data, and to make ground-truth measurements in conjunction with the aircraft measurements.

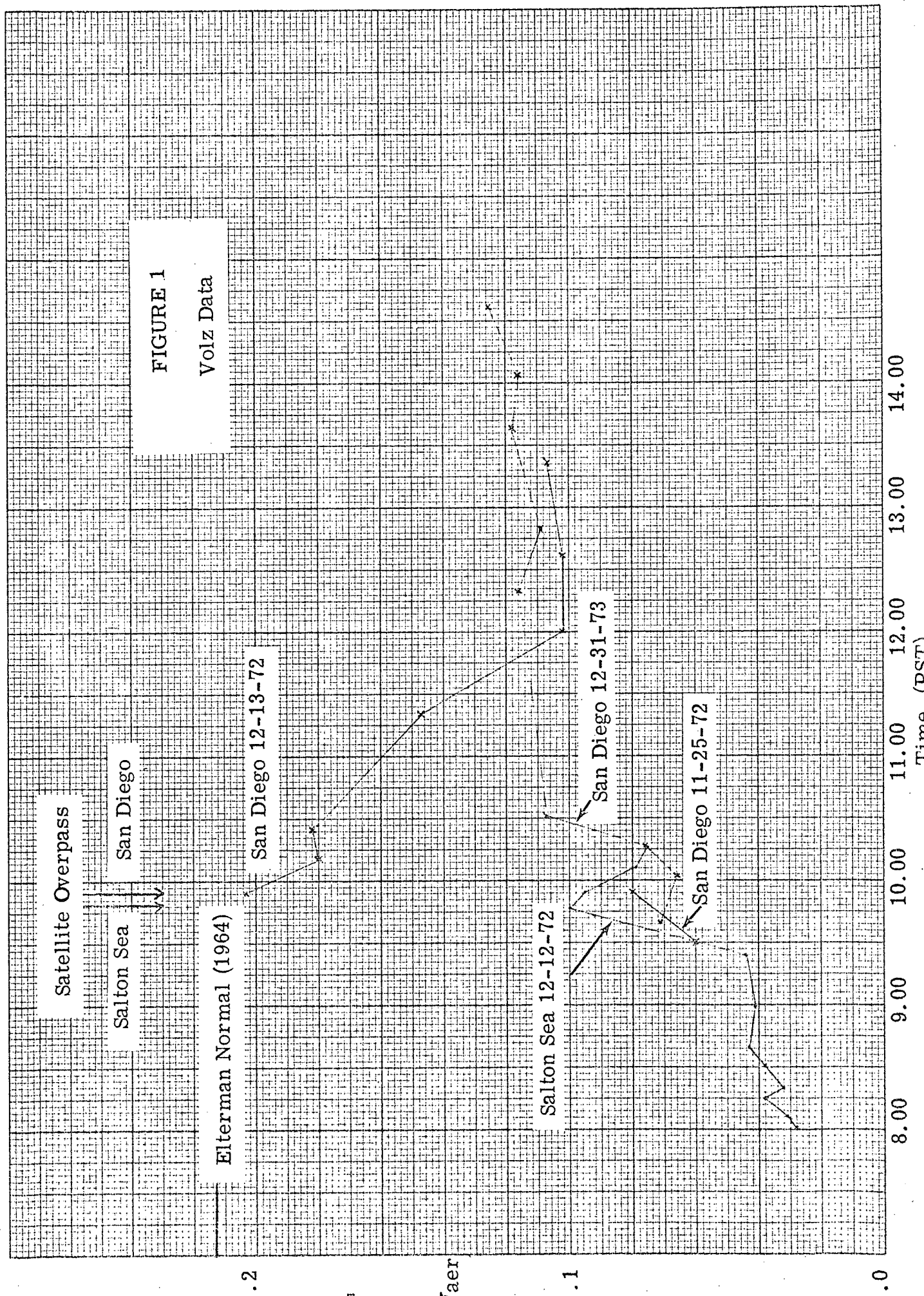
### Significant Results

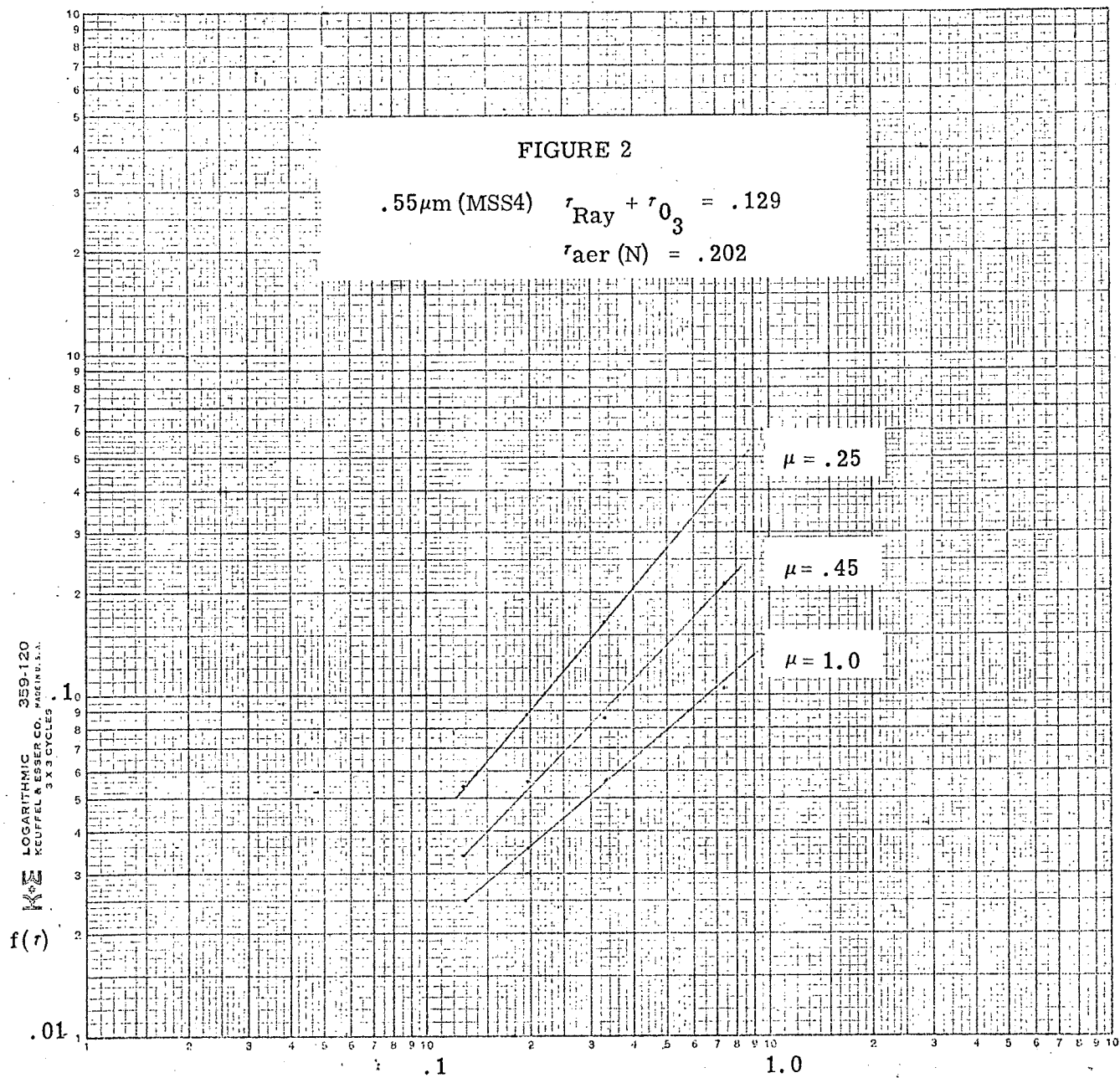
There are no significant results to report in this period. The results of the preliminary data analysis look promising, but further data are required to substantiate them.

### Problems

Only two complete sets and one partial set of data for our Salton Sea test site, and none for our San Diego test site have been received. This lack of data was discussed with User Support and Services in December, and it is expected that the missing data will soon be received.

The Exotech ERTS radiometer is not operating correctly and will be further tested.



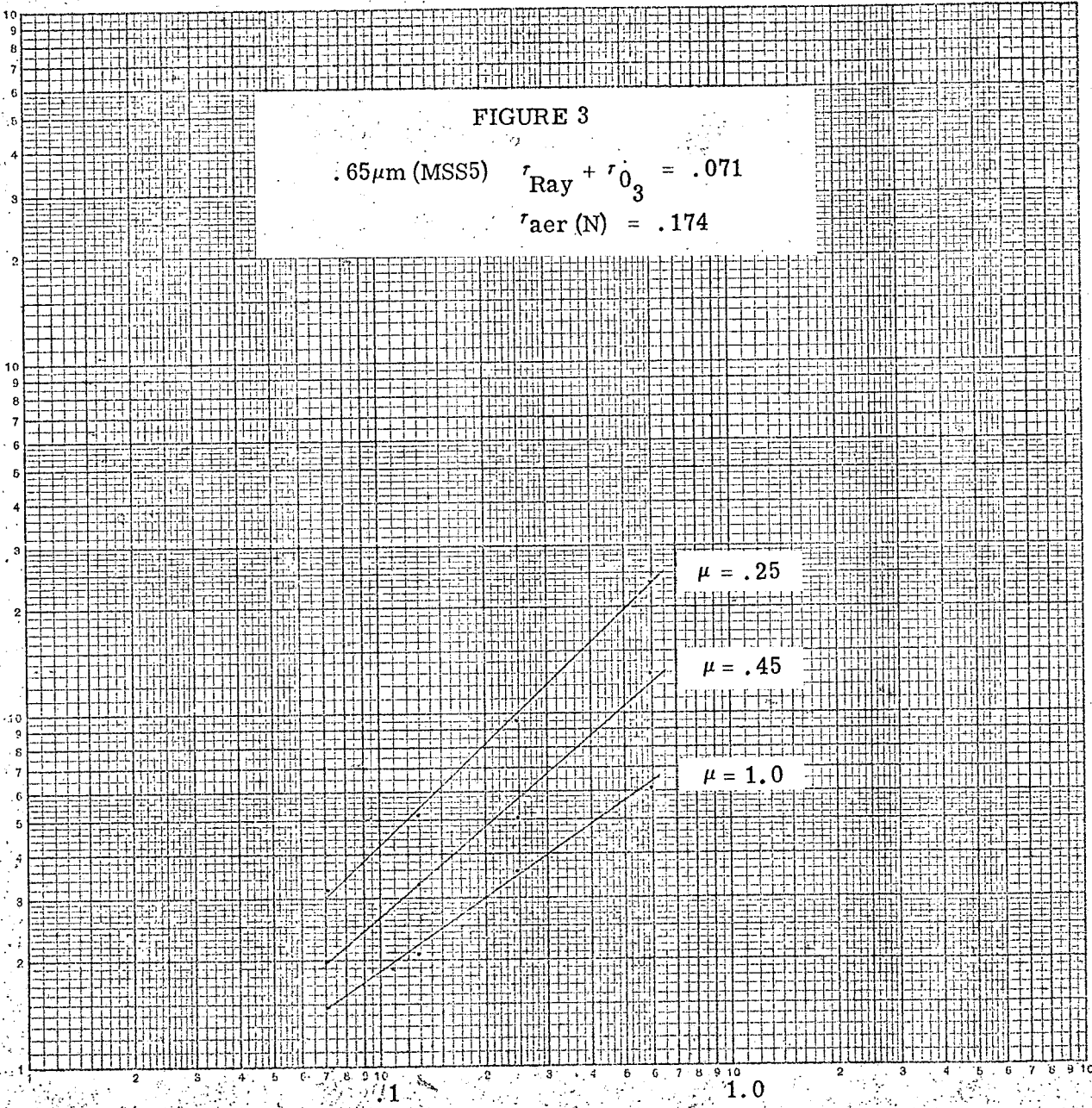


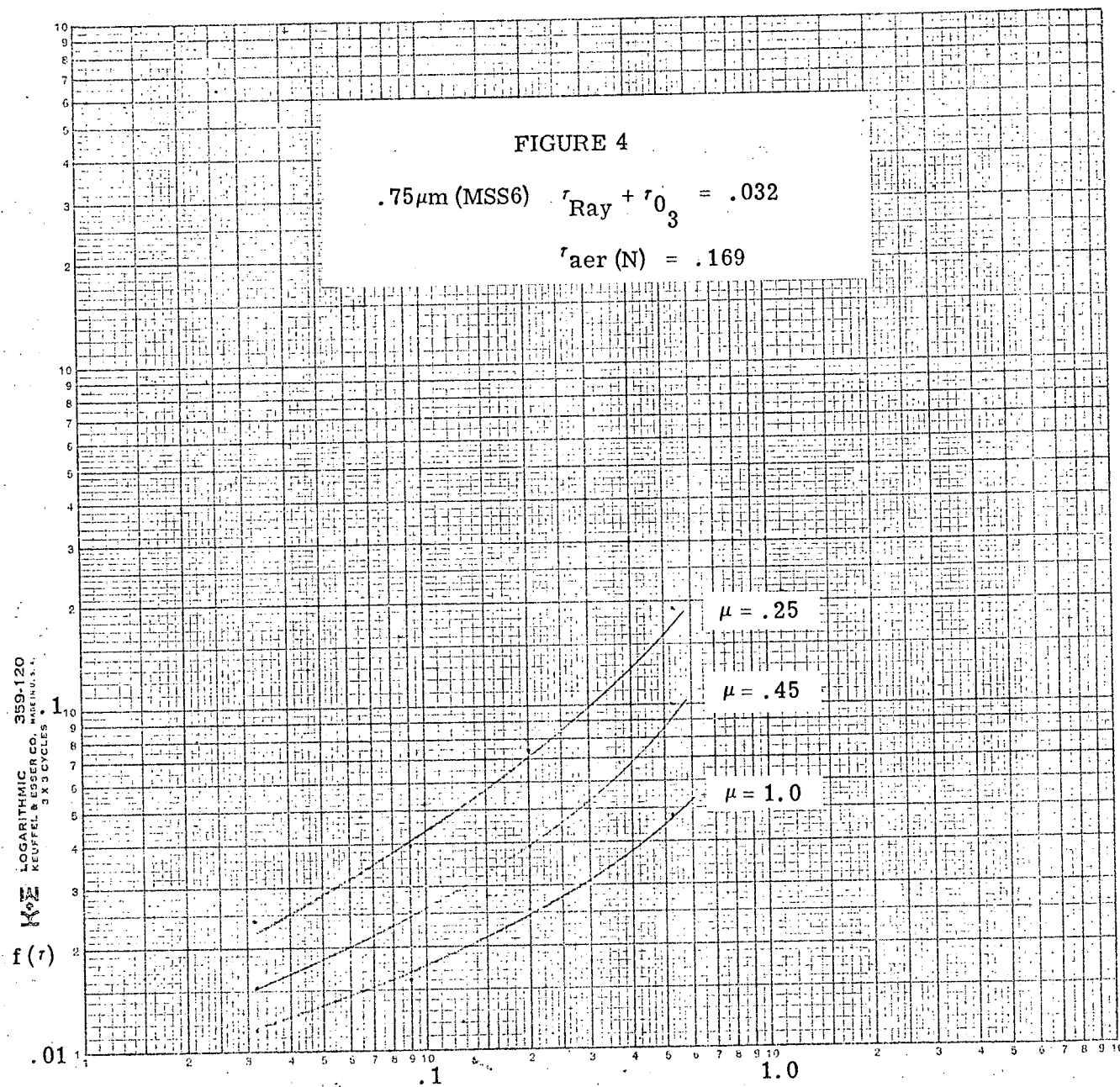


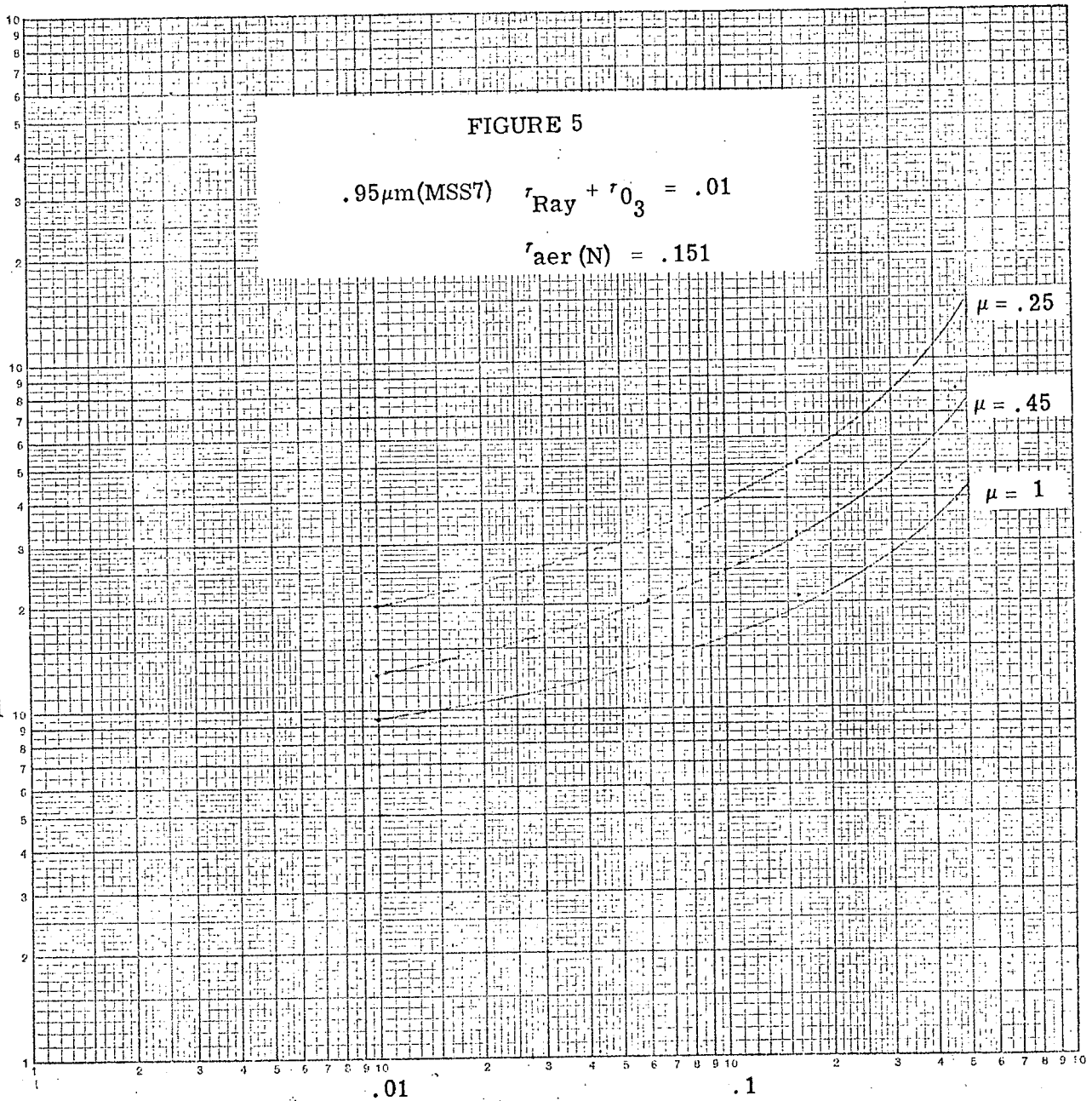
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FIGURE 6  
Salton Sea/Desert

⊙ 8-26-72  
X 10-1-72  
● 11-6-72

